Hawkes Process Modeling of Adverse Drug Reactions with Longitudinal Observational Data

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Adverse Drug Reactions (ADRs)

- Warfarin → Bleeding
- Amphotericin B → Kidney Failure
- Tricyclic Antidepressants → Heart Attack

ADRs lead to high healthcare costs
Multiple Self-Controlled Case Series

Prescription/Diagnosis Record:
- Warfarin
- Tricyclic Antidepressants
- Bleeding
- Heart Attack

Drug Exposure Window:
- Warfarin
- Tricyclic antidepressants

Heuristic-based drug exposure window
Time-invariant drug effect
Hawkes Process

Direct modeling of the records
Different time-varying effect for each drug-outcome pair
Results

<table>
<thead>
<tr>
<th>Marshfield Clinic EHRs</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td># patients</td>
<td>327,824</td>
</tr>
<tr>
<td># adverse outcomes</td>
<td>1,940,681</td>
</tr>
<tr>
<td># drug prescriptions</td>
<td>11,211,769</td>
</tr>
</tbody>
</table>

Cross Validation

Best Performer

Figure: AUC for MSCCS and Hawkes
Thank You!

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